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SURVEY OF RADIOACTIVE WASTE DISPOSAL SITES USING CURV III.(U)
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SURVEY OF RADIOACTIVE WASTE DISPOSAL SITES USING CURV III

by

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OCEAN TECHNOLOGY DEPARTMENT

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Naval Undersea Center, San Diego, California 92132

FOREWORD

The diving operations described in this paper were conducted during the periods 27-30 August 1974 and 18-22 August 1975. The work was funded by the Office of Radiation Programs, Environmental Protection Agency.

This report was reviewed and released by

HOWARD TALKINGTON, Head
Ocean Technology Department

Technical notes are working documents subject to revision or expansion and are not to be referenced in formal publications. They do not represent an official policy statement of the Naval Undersea Center.

ABSTRACT

CURV III, the latest of NUC's CURV vehicles, was used to survey radioactive-waste disposal sites near the Farallon Islands. Radioactive wastes encased in concrete-filled steel drums or concrete vaults were dropped at these sites from 1946 to 1965 in depths ranging from 2400 to 6450 feet. The objective of the survey was to determine the effectiveness of this disposal method and its short-term (10 to 30 years) environmental impact. To this end CURV III was employed to take 35-mm color photographs, make video tape recordings, and take benthic core samples and other specimens. This task was relatively simple because the vehicle's control system and hydraulic power package are readily accessible. Information gained during survey of these sites has added greatly to the limited knowledge of deep-ocean radioactive-waste disposal sites.

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INTRODUCTION

The CURV III submersible, the latest of the Naval Undersea Center's CURV vehicles, was used to survey radioactive-waste disposal sites near the Farallon Islands (Figure 1). The vehicle was modified to take core samples and other specimens and to provide a photographic and video tape record of the survey area. This paper describes the equipment and procedures used for the survey.

BACKGROUND

The ocean disposal of radioactive wastes began in the area of the Farallon Islands in 1946. Since that time, containers of radioactive waste have been dumped within three areas around the Farallons. The first area (Site 1) is the closest to shore and is in a water depth of approximately 300 feet. This site is not a designated site and containers are thought to have been dumped here due to navigational error. The orders to the dump barge contractor are presumed to have been incorrect. Also, it is expected that this site possesses the fewest containers. Site 2 is located at depths from 2400 to 3000 feet and contains the earliest disposal specimens. It was this site that was first surveyed, using the CURV III system. Site 3 is the deepest of the disposal areas and canisters were located at depths from 4700 to 6450 feet. This site contains the most recent and greatest number of specimens. Dumping continued at this site until 1965.

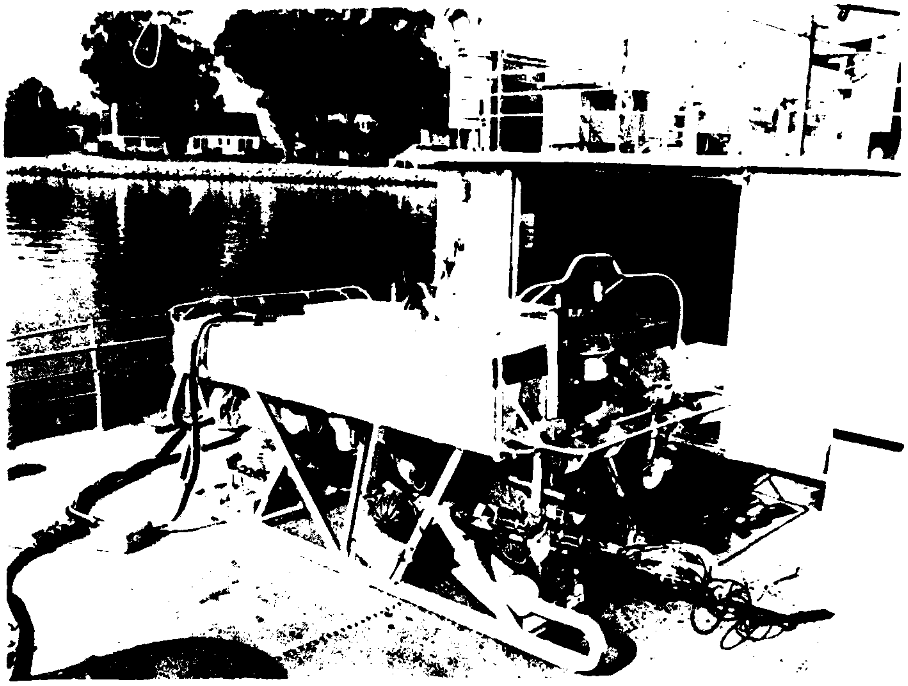
A variety of radioactive materials was disposed of in these dump sites. Typical waste canisters consist of both 30- and 55-gallon steel drums filled with concrete that surrounds the waste material. In addition, several "Glove Box" containers were dumped. These containers are concrete vaults approximately the shape of a cube 8 feet on a side. Radiation levels at the time of disposal are expected to be typically on the order of a few millicuries per container, with occasional higher levels.

The detailed survey and examination of these disposal sites is of interest for two primary reasons. First, to determine the environmental impact of radioactive waste disposal from an historical standpoint; and second, to evaluate the effectiveness of this type of containment and disposal technique for the development of future radioactive-waste management programs.

Initial interest in prosecuting the subject survey operation was generated by the Office of Radiation Programs of the Environmental Protection Agency (EPA). Organizations participating in the survey operation and their responsibilities include the following:

EPA Office of Radiation Programs (EPA/ORP)
: Determination of general operational policy, ultimate decision on technical plan modifications, funding, and final project documentation.

EPA Office of Radiation Programs, Las Vegas Facility (EPA/LVF)
: On-scene radiation surveys and radiation safety.



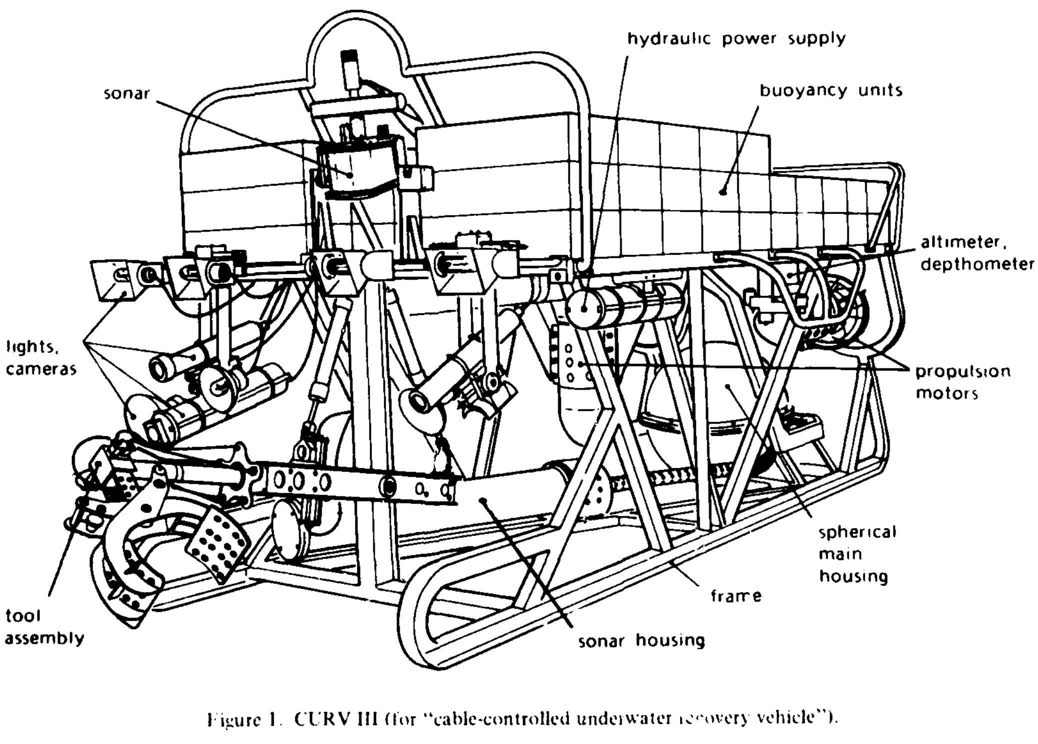


Figure 1. CURV III (for "cable-controlled underwater recovery vehicle").

Interstate Electronics Corp. (IEC)
Under contract to EPA to provide overall operations planning and preparation of final operation documentation.

Scripps Institution of Oceanography (SCI)
Provide current meter instrumentation and furnish current data report.

California Department of Fish and Game (CDFG)
On-scene biological observations and identification.

Navigation Services, Inc. (NSI)
Surface navigation, plotting and tracking

Naval Undersea Center (NUC)
Operation of CURV III system* and support craft for *in situ* sampling, video observation, and photo documentation; and ultimate responsibility for conduct of on-scene operations.

SURVEYS

To date, the CURV III system has been employed to conduct two surveys of the disposal areas. During the period 27 through 30 August 1974, the CURV III system was used to survey Site 2, in which four dives were made, for a total of 30 hours and 57 minutes actual bottom time. The second operation, conducted from 18 through 22 August 1975 for the survey of Site 3, resulted in four dives for a total dive time of 27 hours and 43 minutes. During these operations, several hours of video tapes were made to provide a permanent record of the diving operation. Several core samples 2 inches in diameter and 12 inches long, as well as Shipek grab samples, were made. Finally, a 35-mm photographic record of core location and orientation was obtained, in addition to several hundred 35-mm color photographs of the dump area.

TYPICAL DIVE SCENARIO

A typical diving operation begins with an on-deck check followed by launch of the vehicle and a functional in-water check of all systems during swim-out of the buoyant whip cable. Dive to depth is accomplished in about 1 hour for a 3,000-foot dive. Upon reaching bottom a complete sonar survey is conducted before traversing the bottom. At this time targets of interest are plotted (range and bearing) with respect to the vehicle position and surface navigation position. An initial sonar classification is made of each target based upon its range and size. After a target has been selected for investigation, approach to the target is guided by sonar and vehicle navigation suite. At a range of 5 to 40 feet, depending upon water clarity, visual contact is made and final target identification confirmed using the two TV systems. Targets of high interest may be photographed using the 35-mm camera and a continuous video tape record may be maintained. At the discretion of the scientist in charge

**For a detailed description of this system see NUC TP 338, Guide to the Cable-Controlled Underwater Recovery Vehicle for Deep Operation (CURV III), published by the Naval Undersea Center in April 1973.*

core samples may be taken, and a photographic record may be made of exact core location and orientation (Figure 2). Activation of the Shipek sampler is also at the discretion of topside operators. During a normal dive four core samples and one Shipek sample may be taken. Photographic (35-mm) coverage is limited to approximately 450 frames during each dive. By special rigging the manipulator may be freed for other tasks after the four core samples have been taken. One such task was to collect a large sponge that was growing on one of the waste canisters (Figures 3, 4). In another case the manipulator was used to grasp the end of a container to assess mechanical integrity. From the time of deciding to terminate a dive to on-deck recovery of the vehicle requires about 1 hour for a 3,000-foot dive. After recovery the core samples, specimens, and 35-mm film are removed and the vehicle is rigged for the following dive. Actual time on the bottom averages about 6 hours per dive. Controlling factors in dive times are generally task completion or deterioration of weather conditions (worse than sea state 3 or 4). Because the system is unmanned and powered from the surface dive time is virtually unlimited. Operators may be changed during a dive without interruption of performance.

To a great extent, the ease and rapidity with which the CURV III system was adapted to perform the special tasks required for the operation was due to the lack of any life-support requirements. Hazardous tasks and operations in hostile environments can be performed in complete safety without risk to human operators (Reference 1). Furthermore, the versatility and accessibility of the CURV III electronic control system and hydraulic power package, coupled with an open-frame vehicle design, allow for relatively straightforward addition of special sensors and tools, as in the case of adding a Shipek grab sampler and four-barreled coring tool for this operation.

Figure 2. Core sampler in use near cannister containing radioactive waste.

Figure 3. Sponge growing on radioactive waste disposal canister

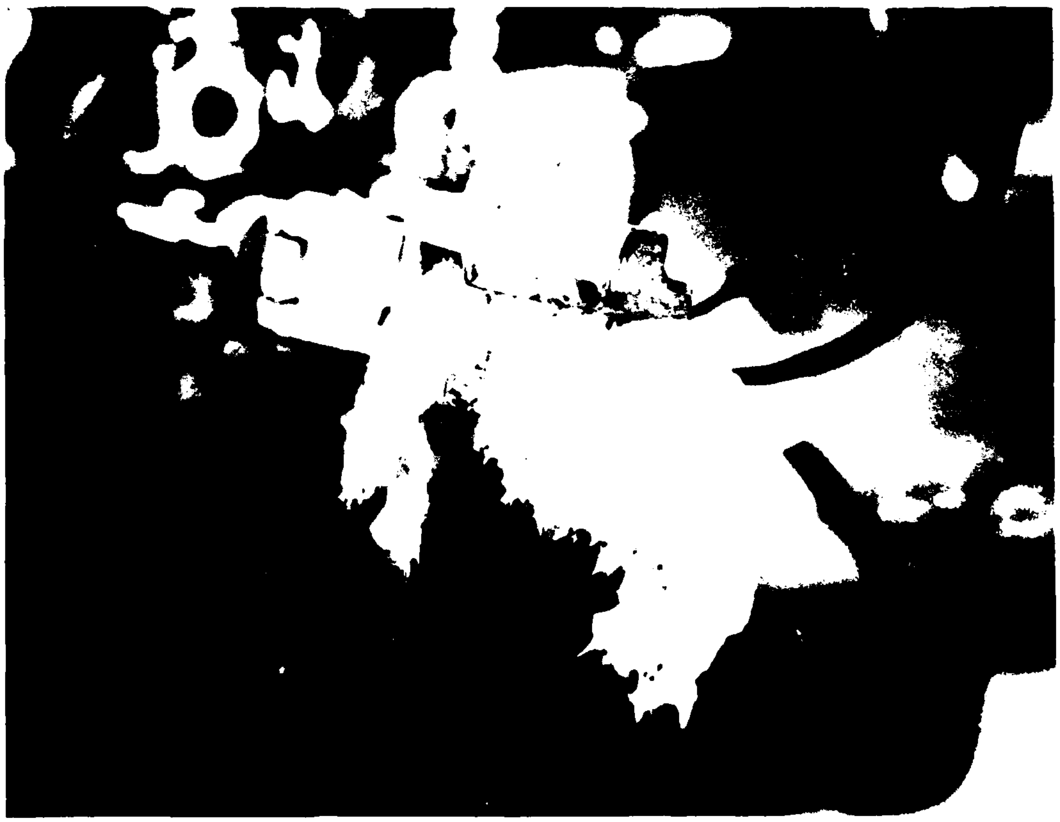


Figure 4. Portion of the sponge recovered using CURV III's manipulator

TOOL MODIFICATIONS

The first series of diving operations around the Farallon Islands was planned and logistic support mobilized 5 weeks prior to actual operations. For this reason and to minimize costs the simplest effective means of collecting sediment samples was sought. Rather than build up an elaborate coring machine it was decided that four cores per dive would be adequate and simple push-in core tubes were adapted to the existing CURV III tool system. The most convenient arrangement is a cruciform shaft mounted on the end of the tool arm manipulator. With this arrangement the individual cores may be rotated into position for use and driven into the bottom using existing tool functions (Figure 5). To obtain larger volume and more precisely located sediment samples a standard Shipek rotating cylinder sampler was attached to the vehicle frame (Figure 6). Control of the sampler was modified so that the sample could be taken at the discretion of the topside operator by activation of one of the vehicle hydraulic functions. With this arrangement it is possible for scientists topside to carefully select sample location and then collect the samples.

DISCUSSION

Prior to this operation, detailed surveys of deep-ocean sites, which require trained observers to evaluate and accurately characterize the biological, geological, and physical status of an area, have typically been conducted from manned submersibles. Aside from the

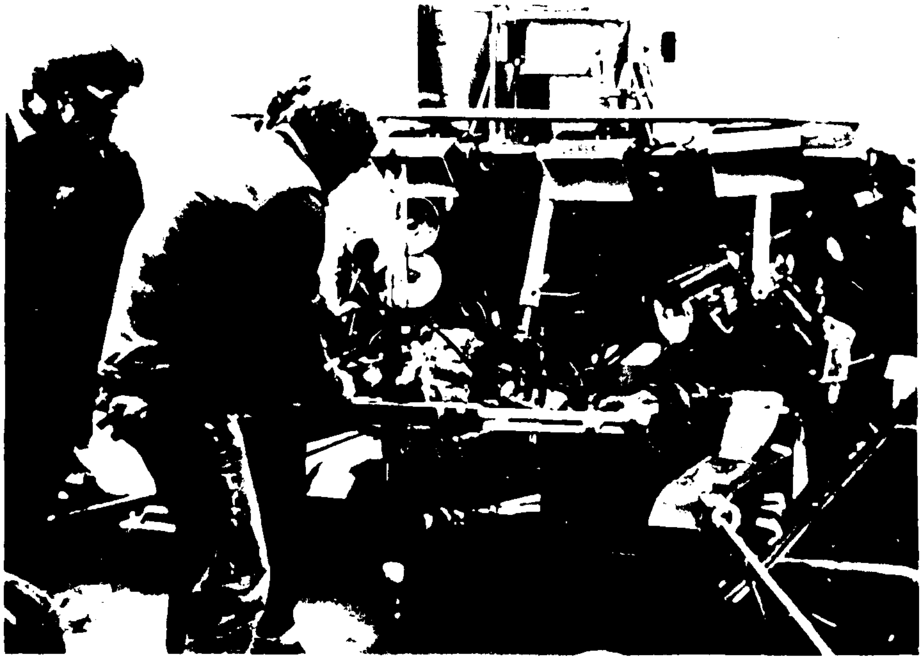


Figure 5. Cruciform core sampler mounted on CURV III.

Figure 6. Shipek sampler mounted on CURV III.

potential personnel hazard involved, manned submersible operations are limited by the number of observers able to participate; and a sizable portion of the operational resources are committed purely to providing, operating, and maintaining a life-support system. With an unmanned system such as CURV III, several trained observers are able to participate simultaneously in the comfort of the "shirt sleeve" environment of the control van, where real-time high-resolution observations can be made with the aid of two independent video systems. In addition, the scientists and system operators have available a high-resolution sonar and navigation suite, a 35-mm color documentation camera, video tape recording equipment, a hydraulically operated tool system that can be modified to perform various tasks, and controls for the precise maneuvering of the vehicle. Dive duration is not limited except by mission objectives, since operators may be changed during a dive and all power and control is provided from the surface via the main control cable.

The two operations conducted are considered highly successful and have added greatly to the limited knowledge of deep-ocean radioactive disposal sites including the effectiveness of this disposal method and the limited-term (10 to 30 years) impact on the environment. Of the 35-mm benthic photographs that were taken, 316 have been selected for further study. In many instances these photographs clearly show container serial numbers and markings. Eighteen core samples and four Shipek grab samples have been delivered to EPA/LVF for analysis, and several hours of benthic video tape recording, as well as top-side video/sound coverage of the operations, have been delivered to EPA ORP for further study.

The CURV III system and concept was originally developed for the primary function of ordnance recovery in support of on-going Navy programs. However, the versatility, reliability, and relatively low operating cost of this system have made it an ideal tool with unique capabilities for application to a wide variety of underwater search, rescue, salvage, recovery, survey, and scientific investigation tasks. The operations described here are but one such application of this unique capability.